

Remarks

Applicants thank the Office for the attention accorded the present Application in the September 9, 2005, Office Action. In that Action, Claims 1, 2, 4, 7, 8, 10, and 11 were examined. Claims 1, 8, 10, and 11 are currently amended. Reexamination and reconsideration of those claims, and the claims that depend there from, is respectfully requested. Also, examination of new Claim 12 is respectfully requested.

Independent Claims 1, 8, 10, and 11 were amended to further recite the temperature of the acidic hydrolysis of the current invention. Support for the recited temperature is found, for example, on page 7 of the application as filed. New Claim 12 has been added to recite the duration of the acidic hydrolysis of the current invention. Support for the recited duration is found, for example, in Table 7 of the application as filed.

35 U.S.C. §103(a) rejections

Claims 1-2, 4, 7, and 10-11 were rejected under 35 U.S.C. §103(a) as being unpatentable over United States Patent No. 4,831,127 to Weibel (hereinafter “Weibel”), Vovlas et al, and United States Patent No. 4,752,579 to Arena (hereinafter “Arena”), in combination. Such rejections are respectfully traversed as follows.

Initially, it is noted that the references have diverse objectives. Weibel and Arena are directed toward two different problems. Weibel attempts to isolate “biopolymers without excessive degradation thereof” (column 4, lines 59-60). That is, Weibel attempts to produce polymers, such as, for example, producing “novel vegetable gums” (column 5, line 1). But, the Arena patent, titled Monosaccharides From Corn Kernel Hulls By Hydrolysis, attempts to isolate monosaccharides from cellulose. Arena attempts to break polymers down into monosaccharides, such as “mainly D-glucose, D-xylose, and L-arabinose” (column 1, line 45). More importantly, however, the proposed combination does not teach the claimed invention.

Weibel, even using Arena’s corn hulls, does not teach Applicants’ selective production. For example, the Office argues:

Weibel teaches a method for isolating biopolymers from parenchymal cell-containing plant material, especially sugar beet and citrus pulp....

Arabinogalactan and pectin were estimated by the concentration of L-arabinose plus D-galactose and D-galacturonic acid respectively (column 16, lines 34-37).

The Office Action fails to recognize that Weibel uses “enzymatic digestion of the hemicelluloses using a combination of ...[two pectinases]” to produce the stated L-arabinose. (column 16, lines 29-37). The use of enzymatic digestion was well known in the art. Applicants’ invention, however, does not require enzymatic digestion to selectively produce L-arabinose. The elimination of a step required by the prior art, with retention of that step’s function, is evidence of nonobviousness.

Further, in making its argument to combine the references, the Office Action states:

Weibel differs from the instantly claimed invention in that Weibel does not use the envelopes of corn as the arabinose-containing plant material; however, it would have been obvious to one of ordinary skill in the art at the time of the invention to use envelopes of corn in view of the teachings of Vovlas and Arena.

This argument fails to recognize that performing Weibel’s method with Arena’s corn envelopes will not achieve Applicants’ unexpected results.

It is known in the art that if one degrades hemicellulose with acid, the most dominant component of the constituent sugar will be produced in the largest amount. Beet pulp is L-arabinose rich. (“End-products of Enzymatic saccharification of Beet Pulp, with a Special Attention to Feruloylated Oligosaccharides” by Micard et al. (1996)). Those skilled in the art would expect that performing Weibel’s method with beet pulp would produce a dominant proportion of L-arabinose. Corn envelopes, however, are D-xylose rich. (“Isolation and Partial Characterization of Feruloylated Oligosaccharides from Maize Bran” by Saulnier et al. (1994)). Those skilled in the art would expect that performing Weibel’s method with corn envelopes would produce a dominant proportion of D-xylose, not selectively produce L-arabinose. But, surprisingly, that is what occurs by using Applicants’ claimed invention. Applicants’ unexpected results are sufficient to overcome the obviousness rejection. In addition to failing to teach the

claimed invention, or its unexpected results, the references give those of ordinary skill in the art no motivation to combine Weibel with Arena.

Those skilled in the art have no motivation to combine Weibel's attempt to produce vegetable gums with Arena's attempt to break polymers down into monosaccharides because to do so would be to add the unnecessary, and costly, step of gum production into the production process. Those wanting to produce gums would use Weibel's teachings; those wanting to produce L-arabinose would use Arena's digestion. More importantly, however, and as mentioned above, motivation to make the proposed combination would be lacking because those having skill in the art would only expect the proposed combination to produce xylose (and not L-arabinose). Here there is simply no expectation of successfully achieving Applicants' invention.

In response to Applicants' previous amendment, the Office Action argues that Weibel and Arena are not contrary to one another because a wide combination of pHs, reaction times and temperatures will be satisfactory in performing Weibel's methods. But this fails to recognize that those skilled in the art would only modify pH, reaction times and temperatures in an attempt to maximize constituent recovery in general, or perhaps, to maximize recovery of D-xylose. Those skilled in the art lack any suggestion, motivation or expectation that they could selectively recover L-arabinose. There is simply no guidance from the prior art that Applicants' processing parameters lead to selective L-arabinose production. Only by using hindsight from Applicants' invention could the Office Action reach such a conclusion. As mentioned above, unexpected results are evidence of nonobviousness.

Further, the Office Action argues that "[Arena's] liquid portion may be separately processed to isolate and purify one or more of the constituent monosaccharides". It is respectfully submitted that the Office Action may confuse selective separation and selective degradation.

In the present invention, L-arabinose contained in the envelopes of corn grains is selectively degraded so that the proportion of L-arabinose in the total amount of the acid-hydrolyzed monosaccharide is 50% or more. This is done by controlling conditions of acidic hydrolysis as defined in Claim 1. Thus, in the present invention, the proportion of L-arabinose in the liquid obtained after acidic hydrolysis is already high, making production of L-arabinose easy (please see, for example, page 4, last line, to page 5, line 7, of the application).

In contrast thereto, Arena's selective separation means to separate L-arabinose from a mixture of monosaccharides including L-arabinose by chromatography, etc.

Selective separation and selective degradation are completely different treatments. Fig. 1 and column 3, lines 53-65 of Arena, as cited by the Office, merely show selective separation.

And, it is again emphasized that Arena discloses that at 60°C the solubilizing rate of raw material is only 23.2% ($3.3+8.3+11.6=23.2$)(column 5, Table 1). At 70°C or higher, the solubilizing rate increases 37% or more, but selective production of L-arabinose is not achieved. Thus, according to the method of Arena, selective production of L-arabinose and high yields of soluble components are not realized at the same time.

Amendments to the Claims

Amended Claims 1, 8, 10, and 11 differ from Weibel not only in terms of raw materials, but also in terms of reaction temperature. Weibel adopts a high reaction temperature, or severe condition. Thus, using the method of Weibel, raw material will be completely (and non-selectively) degraded to its constituent monosaccharides.

On the contrary, the present invention adopts a low reaction temperature, or mild condition. Thus, using the method of the present invention, raw material is selectively degraded, and L-arabinose, which is a minor constitutive monosaccharide in envelopes of corn grains, is selectively degraded. The claimed reaction temperature produces unexpected results.

Even if the raw material in Weibel is replaced with envelopes of Volvas's or Arena's corn grains, what is produced most is not L-arabinose, but xylose, because xylose is a major constitutive monosaccharide in envelopes of corn grains.

In Weibel, it is not deemed to be simply a matter of design for those skilled in the art to lower the reaction temperature so as to achieve the present invention. There is no motivation to lower reaction temperature, and no indication that Applicants' lower reaction temperature will produce the unexpected results of the present invention. In fact, Weibel's disclosure regarding temperature is contrary to Applicants' claimed temperature because Weibel teaches that "high temperatures [e.g. 165° C] are desired for high yield" (column 17, lines 61-63).

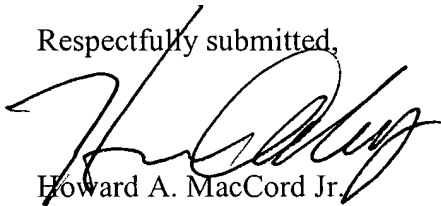
New Claim

Regarding newly added Claim 12, it is respectfully submitted that neither Weibel's short reaction time (on the order of seconds) nor Arena's long reaction time (5.5-6 hours) discloses the reaction time recited in Claim 12.

Conclusion

The Applicants submit that by this amendment, for the reasons given above, they has placed the case in condition for immediate allowance and such action is respectfully requested. However, if any issue remains unresolved, Applicants' attorney would welcome the opportunity for a telephone interview to expedite allowance and issue.

Respectfully submitted,



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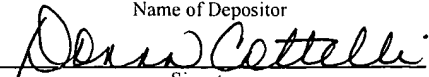
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